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# The health of mangroves in Mayotte Island (Indian Ocean)

## Comparison of stakeholders and scientific knowledge

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Conservatoire du littoral



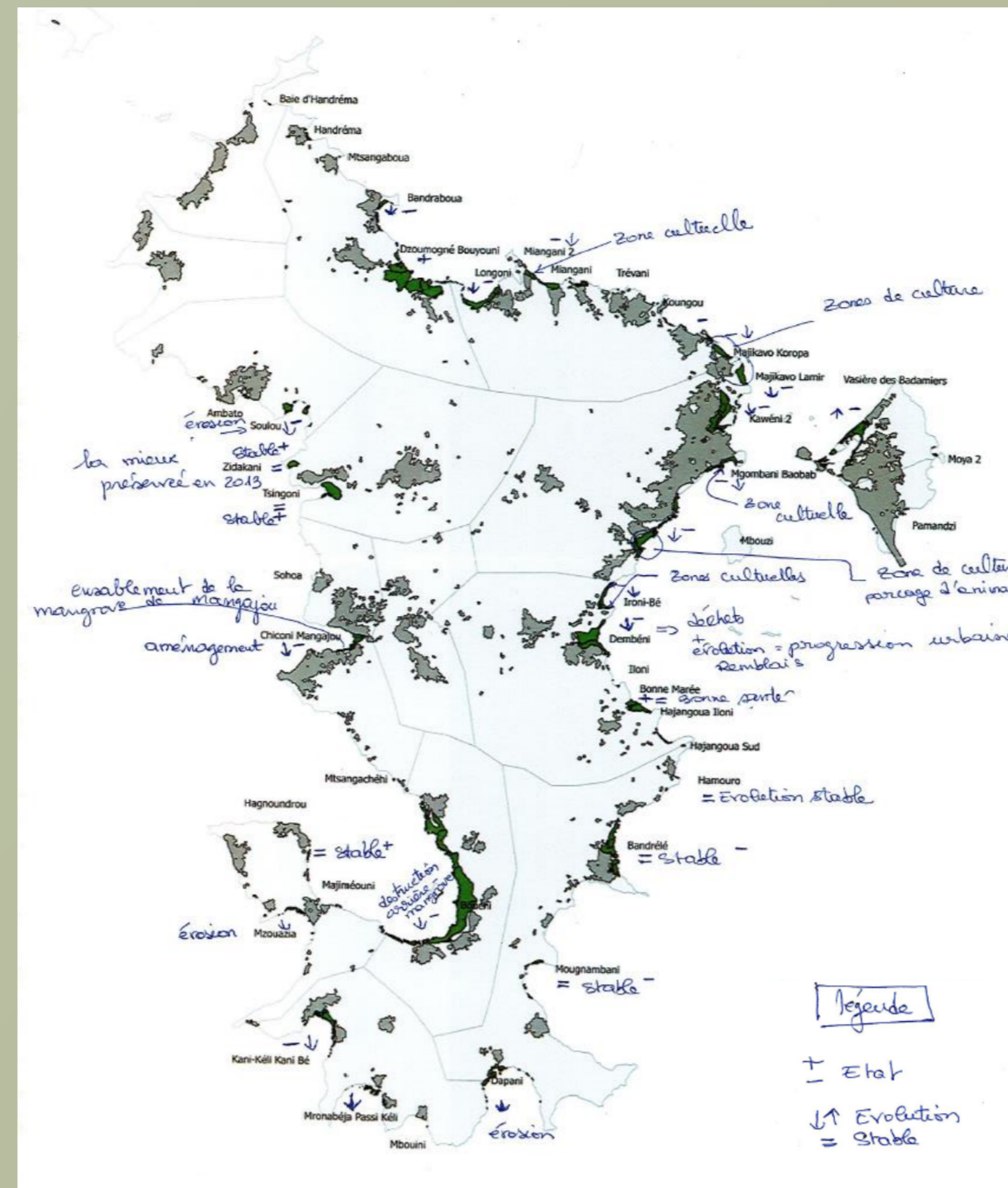
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## Introduction

The management of mangrove is decided and applied, in western territories, essentially, by planners, managers and decision-makers under the influence of non-governmental associations. Regarding the mangroves of the Mayotte Island, it is the premises both for scientific research and for the development of management plans.

Mayotte is a tropical Island of 375 km<sup>2</sup> located in the south western Indian Ocean which counts 700 ha of mangrove covering 29% of the coastline. Since 2011 when Mayotte became a French department public institutions have to produce management plans imposed by French and European rules.

Quickly after its emergence in ecological scientific literature, the concept of ecosystem state is used in strategic documents. Indeed, in 2008, the Marine Strategic Framework Directive demands to achieve the good ecological status without defining the notion. Defining criteria of ecosystem health that incorporate an understanding of uncertainty or threshold limits is needed to trigger management intervention (O'Brien et al 2016). In this context, we examine how this concept is understood by stakeholders in Mayotte and applied to mangroves and make a comparison with indicators from the scientific literature.



Example of a particularly detailed mental map on the health state of mangroves in Mayotte

## Method

→ 16 semi-structured interviews with stakeholders influencing the conservation and management of the island's mangroves in order to better understand their knowledge (2017):

- 8 public institutions
- 2 government agencies
- 1 local government
- 5 associations or NGO

→ We focus here on 3 questions/exercises of the interview guide:

- Indicate on a map presenting the mangroves of Mayotte their health state (good, fair, bad) for the ones that the interviewees knew
- Comment the mental map produced
- Explain which criteria can be used to decide that a mangrove is in good health

## Perception of mangrove health

Out of 43 mangroves located on the background map presented to the interviewees, 11 were not assessed. All of them are less than 2.15 ha, however, some small mangroves have been assessed, the ones mostly located in a protected or labelled area.

Overall, respondents more easily chose bad (87 responses) or good (73 responses) to characterize the mangroves they knew rather than the fair state response (6 answers).

The mangroves for which more than half of the managers have expressed an opinion are:

- the island's largest mangroves
- those known for their rapid evolution (high growth at Badamiers, see box below ; rapid decrease at Dapani).

It appears that the mangroves in the south of the island that undergo a rapid decrease and those adjacent to the Mamoudzou urban area were more easily designated as mangroves in poor condition.

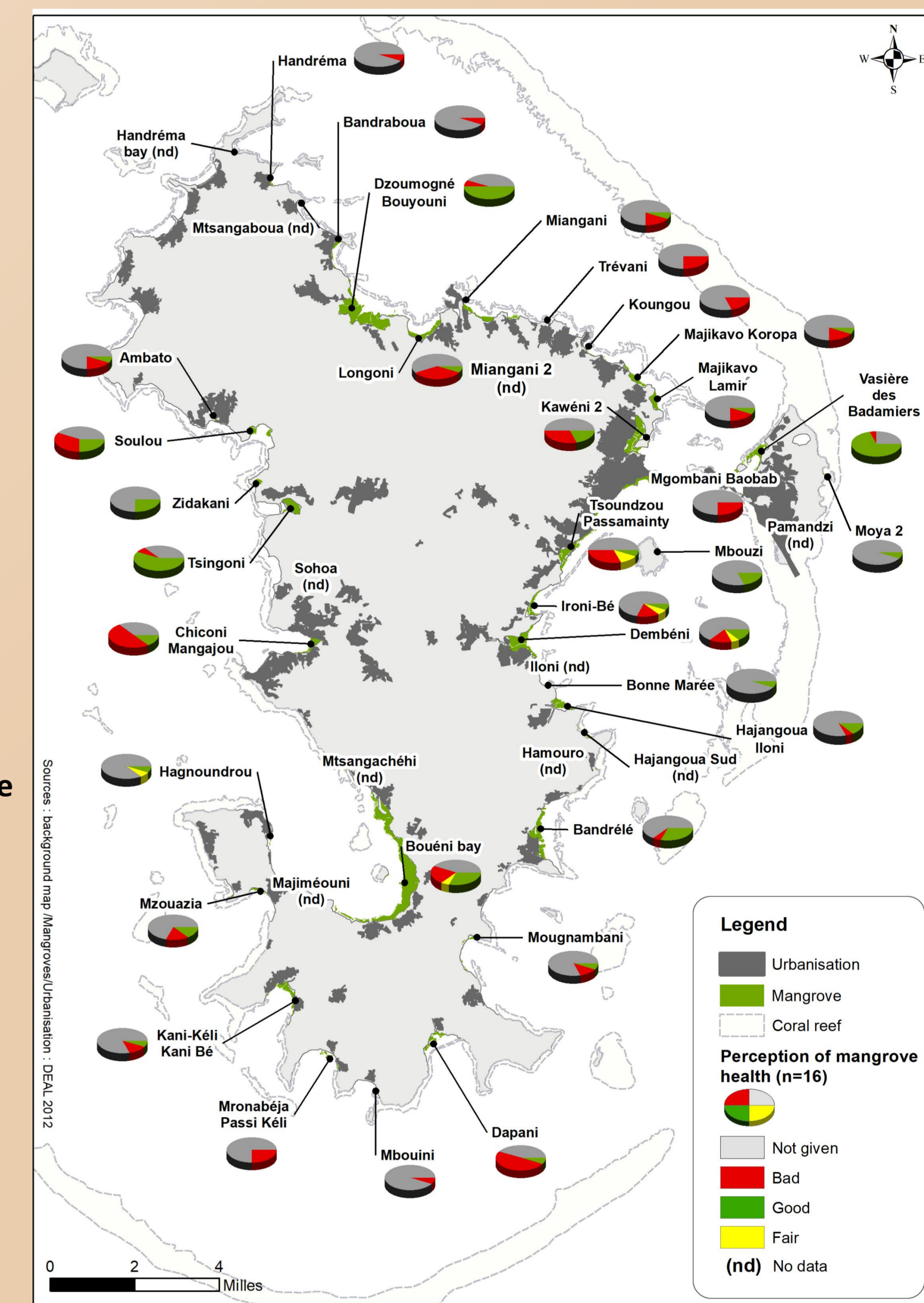
On comments given by the 16 interviewees on their maps, only 3 questioned the notion of "health state" and 4 their ability to judge the health state of the mangroves of Mayotte.

*"I don't know how to say that a mangrove is in a good or bad health. I am not sur that we have the indicators to say what is the good health and the bad health. And personally, I don't know the mangroves enough, I went inside of very few mangroves [...]. I think that scientifically we do not know enough to say what is in good health and in bad health" (E4, Marin Natural Parc).*

- Overall, respondents have a **limited knowledge** of the health of mangroves in Mayotte but **few are aware of it**.
- **Focus on causes** of health degradation rather than consequences.
  - ❑ **Understanding** that natural causes (**seaward erosion**) can **explain mangrove degradation** (south mangroves) based on knowledge of previous research.
  - ❑ **Concern** (no local studies) that **mangroves neighbouring highest urbanised area are in bad health** because of anthropogenic impact. Interviewees considered that **waste impacts aesthetics**: *"a mangrove in good health is a clean mangrove"* (E3, Marin Natural Park).



## Synthesis of perception of mangrove health in Mayotte by interviewed stakeholders



### Expansion of the mangrove of Badamiers

*"The mangrove of Badamier, I think it is in expansion, I put a plus [good health]" (E15, birds NGO)*



*"It's really heaps and heaps of waste piled up in this place but paradoxically the mangrove likes it because it obviously proliferates. [...] And it get directly the waste water. [...] So, I do not know if I can say it is in bad health. [...] a priori you might be tempted to say "oh my god it's the sickest because it's swimming in this waste" but nevertheless this one, it doesn't disappear..." (E2, Coastal Protection Agency)*

The mangrove of Badamiers, reported on 19th century maps, they no longer existed in 1950, completely cut down. Regeneration was further prevented by the construction of a road and dike in 1848 that stopped saltwater from the lagoon attaining the marsh. The remarkable recovery of this mangrove stand (37.31 ha in 2016), despite the highly urbanized context, is related to renewed seawater intrusion following progressive degradation of beachrock outcrops that hitherto formed a natural barrier between the mangroves and the lagoon.

## Good health criteria

The interviewees cited on average nearly 3 criteria to characterize a mangrove in good condition. For half of the respondents, the criteria mentioned are associated with the state of the plant community and the low anthropogenic impact.

- ❑ Condition of the plant community: living or dead mangrove trees (n=7), living mangrove (n=2), green mangroves (n=2)
- ❑ Low anthropogenic impacts: clean (n=5), low anthropogenic impacts (n=3)
- ❑ Structure of the plant community: tall trees (n=1), complete zonation pattern (n=3), presence of the back mangrove (n=1), dense (n=3)
- ❑ self-regeneration: self-regenerates (n=3), many juveniles (n=3)
- ❑ Fauna: presence (n=4), no exotic species (n=1)
- ❑ Surface dynamics: increasing (n=2), stable (n=2)
- ❑ Performs all functions (n=2)
- ❑ Significant biodiversity (n=1)
- ❑ State of equilibrium (n=1)

Scientists themselves have a hard time to define precisely what is ecosystem health. Yet, recent contributions on the debate agree it must include multiple ecosystem functions in addition to measures of ecosystem structure (O'Brien et al 2016, Palmer & Febria 2012).

Most interviewees perceived that health is a **multi-criteria evaluation** although **few focus on ecological integrity/ecosystem functioning (n=2)**.

❑ **Focus on plant community** (*"tree height, density, juvenile regeneration"*) (n=17) but **few at scale of ecosystem** (assemblage composition and zonation) (n=4).

Types of criteria and wording reflect **limited knowledge of scientific literature** on ecosystem health:

- ❑ **Criteria of human impact/desired state**, not health (*"clean", "no wood harvesting"*) (n=8)
- ❑ **Double-sided criteria** that can respond positively to wastewater (*"big tree", "green mangroves"*) or that might not only have a linear tendency (*"natural cycle" of surface dynamics*) are used as indication of good health (n=7)
- ❑ **Poorly defined criteria** (*"living mangrove", "green mangrove", "equilibrium state"*) (n=5)

## Reference

O'Brien, A., Townsend, K., Hale, R., Sharley, D., Pettigrove, V., 2016. How is ecosystem health defined and measured? A critical review of freshwater and estuarine studies. *Ecol. Indic.* 69, 722–729.  
Palmer, M.A., Febria, C.M., 2012. The Heartbeat of Ecosystems A Boron-Boron Triple Bond. *Ecology* 336, 1393–1394.

## Conclusion

- Although stakeholders are involved in ecosystem health evaluation, their understanding of the concept is limited. The format of the interview, however, relies only on their memory to define a complicated concept.
- The ARESMA project implements knowledge exchange between scientists and stakeholders in order to improve mangrove health evaluation.